

Aim: Plan & carry out an investigation into the effect of a factor on human reaction time.

## Equipment



**Reaction time is the taken to respond to a visual stimulus**



- Choose a factor to investigate that you believe has an effect on reaction time
- Carry out experiments to measure reaction time

**Factors affecting reaction time:**

- Age
- Drug use (e.g. caffeine)

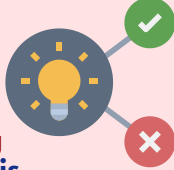
- Stress
- Distractions



## Creating a Hypothesis

A hypothesis predicts a relationship between two variables:

1. **Observe** which variables might be having an effect on variable.
2. **Select** a variable to investigate.
3. Create a **question** you want to answer, followed by a **prediction backed by scientific reasoning** - this is your hypothesis.



## What is happening?



**Independent variables include:**

**Background noise**

1. Perform experiment in silence
1. Repeat experiment with loud background music

**Caffeine consumption**

1. Carry out experiment
2. Repeat after the person has drank a caffeinated drink

**Dependent variable** → Distance caught (equates to reaction time)

**Control variables include:**

- Use of dominant hand
- Height the ruler is dropped from
- Ruler orientation
- Practice time

## Method:

### Preparation

- 1) In a pair, decide who is **Person 1** and **Person 2**.
- 2) **Person 1** sits down on a chair and puts the forearm of their **dominant arm** across the **table**, with their hand overhanging the edge.
- 3) **Person 2** holds a ruler **vertically** (from a chair) with the bottom end (0cm mark) between **Person 1's thumb and 1st finger**.
- 4) **Person 2** tells **Person 1** to be ready to catch the ruler.
- 5) When ready, **Person 2** releases the ruler.
- 6) **Person 1** catches the ruler as quickly as possible.
- 7) Record the number on the ruler **level with Person 1's thumb** on a table.
- 8) Repeat steps 2-7 several times with **Person 1** catching the ruler.
- 9) Swap roles, so **Person 2** catches the ruler and **Person 1** drops it.
- 10) Use a **conversion table** to convert ruler measurements into reaction time.
- 11) **Make the necessary changes in order to investigate the chosen variable.**
- 12) Repeat steps 1-10 with the new variable.

## REQUIRED PRACTICAL 7 REACTION TIME

### Example Results Table (Independent variable - noise)

Drop test attempt	Ruler measurements in cm				Reaction time in seconds			
	Person 1 No noise	Person 2 No noise	Person 1 Noise	Person 2 Noise	Person 1 No noise	Person 2 No noise	Person 1 Noise	Person 2 Noise
1	29		52		0.24		0.33	
2	26		42		0.23		0.29	
3	31		45		0.25		0.30	
4	31		25		0.25		0.23	
5	26		39		0.23		0.28	

Repeat as many times as possible

This experiment often results in lots of errors because many factors can affect results.

### Analysis of Results

The lower the reaction time, the faster the reaction time. For example in the table above: "Person 1's reaction time was faster before it was caught with noise, with average time before noise was 0.24 seconds compared to 0.29 seconds. This supports the hypothesis that noise increases the reaction time of Person 1."

### Considerations

It is very difficult to control variables.

E.g. Results could show someone is faster after the independent variable was changed but because they have practiced catching the ruler, not because of the independent variable.

### Potential Improvements

Measure reaction time in milliseconds to increase accuracy.

Lots of participants and attempts are needed to produce reliable results.



### Alternative practical

Use a computer programme.



Participants click the mouse when the colour on the screen changes

Extract from table

Ruler reading (cm)	Reaction Time (s)
1	0.05
2	0.06
3	0.08
4	0.09
5	0.10



# Exam Style Questions - Reaction Time



1) Two students performed a practical to investigate reaction time using the following method:

- Student 1 sits with their arm resting on the table so that their hand hangs over the edge.
- Student 2 holds the ruler so that the 0cm mark is level with student 1's thumb and finger.
- Student 2 drops the ruler and student 1 catches as fast as they can.
- The distance on the ruler is recorded.

They followed these steps 9 times before swapping roles and repeating the process. State three variables the students controlled in this practical. (3 marks)

---



---



---

2) Give two reasons why a computer program to measure reaction time is more likely to be more valid than the ruler drop method. (2 marks)

---



---



---

3) Table 1 shows the results of an investigation of a group of students investigating the effect of caffeine on reaction time. In their experiment, they completed the ruler drop test before drinking a strong cup of coffee and 15 minutes after drinking the coffee.

a) What do the means suggest about the effect of caffeine on reaction time? (1 mark)

---



---

b) Give one reason why a scientist might not accept this conclusion. (1 mark)

---



---



---

Distance ruler fell (cm)	Distance ruler fell (cm)
Before drinking coffee	After drinking coffee
15	13
19	17
13	11
21	8
18	17
25	10
12	14
21	13
Mean = 18.0	Mean = 12.8

Table 1

4) Two students performed a practical to investigate reaction time using the following method:

- Student 1 sits with their arm resting on the table so that their hand hangs over the edge.
- Student 2 holds the ruler so that the 0cm mark is level with student 1's thumb and finger.
- Student 2 drops the ruler and student 1 catches as fast as they can.
- The distance on the ruler is recorded.

They followed these steps 4 more times before swapping roles and repeating the process. Table 2 shows Student 1's result.

a) What was the median result?

---

Attempt number	Distance ruler dropped in mm
1	109
2	114
3	123
4	125
5	120

Table 2

b) Calculate the mean reaction time to 3sf, using the equation:

$$\text{reaction time in s} = \sqrt{\frac{\text{Mean drop distance (cm)}}{490}} \quad (4 \text{ marks})$$

# Exam Style Questions - Reaction Time



1) Two students performed a practical to investigate reaction time using the following method:

- Student 1 sits with their arm resting on the table so that their hand hangs over the edge.
- Student 2 holds the ruler so that the 0cm mark is level with student 1's thumb and finger.
- Student 2 drops the ruler and student 1 catches as fast as they can.
- The distance on the ruler is recorded.

They followed these steps 9 times before swapping roles and repeating the process. State three variables the students controlled in this practical. (3 marks)

**One mark for each of the following, up to a maximum of three marks:**

- Drop ruler from the same height
- Keep arm resting in the same way
- Drop the ruler without any force
- Use the same ruler
- Use dominant hand
- Line up hand/thumb with ruler at the same point each time.

2) Give two reasons why a computer program to measure reaction time is more likely to be more valid than the ruler drop method. (2 marks)

**Mark one for one of the following:**

- Participant cannot pre-anticipated the colour is about to change/no indication before the colour changes
- Participant might be able to tell when the other person is about to/is preparing to drop the ruler

**Mark two for one of the following:**

- Measurement is more precise on the computer
- Resolution of computer timer is higher than manually stopping a stopwatch

3) Table 1 shows the results of an investigation of a group of students investigating the effect of caffeine on reaction time. In their experiment, they completed the ruler drop test before drinking a strong cup of coffee and 15 minutes after drinking the coffee.

a) What do the means suggest about the effect of caffeine on reaction time? (1 mark)

**One mark** - caffeine decreases reaction time/caffeine causes quicker reactions

b) Give one reason why a scientist might not accept this conclusion. (1 mark)

**One mark** - Idea that results before and after caffeine consumption overlap/wide set of results

Accept reference to only one set of results/one person/small sample

Distance ruler fell (cm)	Distance ruler fell (cm)
Before drinking coffee	After drinking coffee
15	13
19	17
13	11
21	8
18	17
25	10
12	14
21	13
Mean = 18.0	Mean = 12.8

Table 1

4) Two students performed a practical to investigate reaction time using the following method:

- Student 1 sits with their arm resting on the table so that their hand hangs over the edge.
- Student 2 holds the ruler so that the 0cm mark is level with student 1's thumb and finger.
- Student 2 drops the ruler and student 1 catches as fast as they can.
- The distance on the ruler is recorded.

They followed these steps 4 more times before swapping roles and repeating the process. Table 2 shows Student 1's result.

a) What was the median result? (1 mark)

**One mark** - 120

Attempt number	Distance ruler dropped in mm
1	109
2	114
3	123
4	125
5	120

Table 2

b) Calculate the mean reaction time to 3sf, using the equation:

$$\text{reaction time in s} = \sqrt{\frac{\text{Mean drop distance (cm)}}{490}} \quad (4 \text{ marks})$$

**Mark one** - Mean = 118.2mm

**Mark two** -  $\sqrt{\frac{11.82}{490}}$

**Mark three** - 0.1553

Three marks for 0.1553 with no working.

**Mark four** - 0.155

Four marks for 0.155 with no working.